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ABSTRACT OF INVITED TALK AT:

**“Symposium on Particle Astrophysics and Cosmology Including
Fundamental Interactions “ September 8-13, 2011, Moorea, French
Polynesia**

**Title: HIGH ENERGY ASTROPHYSICS TESTS OF LORENTZ INVARIANCE AND
QUANTUM GRAVITY MODELS**

High-energy astrophysics observations provide the best possibilities to detect a very small violation of Lorentz invariance such as may be related to the structure of space-time near the Planck scale of $\sim 10^{-35}$ m. I will discuss here the possible signatures of Lorentz invariance violation (LIV) from observations of the spectra, polarization, and timing of gamma-rays from active galactic nuclei and gamma-ray bursts. Other sensitive tests are provided by observations of the spectra of ultrahigh energy cosmic rays and neutrinos. Using the latest data from the Pierre Auger Observatory one can already derive an upper limit of 4.5×10^{-23} to the amount of LIV at a proton Lorentz factor of $\sim 2 \times 10^{11}$. This result has fundamental implications for quantum gravity models. I will also discuss the possibilities of using more sensitive space based detection techniques to improve searches for LIV in the future.